SSI

SMART SENSOR INDICATOR

PLUG & PLAY IEEE 1451.4 COMPLIANT

OPERATOR MANUAL (USB)

Transducer Techniques®

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REVISED 02/2015

2. TEDS IEEE 1451.4 INTRODUCTION

The SSI Smart Sensor Indicator is a TEDS IEEE 1451.4 Plug and Play Smart Load Cell Meter.

TEDS, or Transducer Electronic Data Sheet, is a set of electronic data in a standardized format defined within the IEEE 1451.4 standard. The data is stored in an EEPROM with the sensor. It specifies what type of sensor is present, describes its interface, and gives technical information such as sensitivity, bridge type, and excitation.

The SSI automatically detects when a TEDS IEEE 1451.4 compliant Load Cell, Torque Sensor or Pressure Transducer is connected. Once a TEDS sensor is detected, the SSI displays “TEDS”, reads the EEPROM, stores the information in memory, and performs an automatic configuration.

The built-in sensor-related EEPROM may be any of the following types: DS1973/DS2433, DS2431 or DS1971/DS2430A. The automatic system configuration function performs all steps needed to calibrate the TEDS IEEE 1451.4 compliant sensor and SSI as a system. This includes the configured precision of either 32 bits, 19 bits or 11 bits.

Using the SSI with a TEDS IEEE 1451.4 compliant Load Cell, Torque Sensor or Pressure Transducer is as easy as plugging a mouse into a computer, making it a true plug-and-play experience.

The SSI may also be used with a non-TEDS sensor requiring manual configuration and calibration.

3. SSI PRODUCT INTRODUCTION

The SSI Smart Sensor Indicator is a hand-held, programmable meter and datalogger for load, torque or pressure applications. Advanced capabilities include:

1. "Plug and Play" operation with automatic scaling at power-up with TEDS IEEE 1451.4 compliant load cells.
2. Instrument Calibration indicator (CAL INSTRUMENT) to show when the meter is due for calibration. Flashing indicates either that the instrument is due for calibration or will be due in less than 30 days. Steady indicates that the instrument is now due for calibration.
3. Sensor Calibration indicator (CAL SENSOR) to show when an actively attached TEDS sensor is due for calibration. Flashing indicates either that the sensor is due for calibration or will be due in less than 30 days. Steady indicates that the sensor is now due for calibration.
4. Menu-driven scaling of non-TEDS-compliant load cells via keypad with a choice of two scaling methods: manually entered coordinates of two points, or reading coordinates of two points using input signals.
5. PC-based scaling of non-TEDS-compliant load cells using Instrument Setup software, again with a choice of two scaling methods.
6. Keypad selectable units of measure for load, torque or pressure, with automatic conversion of readings between units.
7. Lockout feature to simplify meter operations and prevent inadvertent changes.
8. Ultra-fast signal sampling rate of 15,360 samples/second (when set for 60 Hz noise rejection) or 12,800 samples/second (when set for 50 Hz noise rejection).
9. Normal conversion rate of 60/second (when set for 60 Hz noise rejection) or 50/second (when set for 50 Hz noise rejection), with digital averaging of every 256 samples. Allows display of filtered or unfiltered readings, capture of Peak, First Peak or Valley.
10. Selectable Fast conversion rates up to 7,680/second (when set for 60 Hz noise rejection) or 6,400/second (when set for 50 Hz noise rejection). Always unfiltered, allows capture of Peak or First Peak.
11. Display update rate at 3.75/second (when set for 60 Hz noise rejection) or 3.125/second (when set for 50 Hz noise rejection). Display batch averages of 16 conversions or moving averages of conversions.
12. USB port for direct connection to a PC at baud rates from 300/second to 38.4k/second.
13. Data logging to internal memory of up to 16,000 time and date stamped displayed readings at up to 60 or 50 captures/second. Data logging may be single or continuous.
14. Selectable memory protection to prevent overwriting previously stored data.
15. Recall of internally stored readings to the meter display, a PC, or a printer with a USB interface. Recall may be single or continuous (standard capability).

16. Recall of last meter calibration dates.

17. Data logging of time and date stamped values in real time via USB to a PC or printer. The values may be the current reading, Peak, Valley, or any combination thereof.

18. Optional PC Data Logging Software, P/N SSI-DLS. Collects real-time or stored data via USB. Lists, plots or stores meter data in PC memory.

19. Two built-in, solid state alarm relays, with LED and audible indications. Selectable relay latching or non-latching, setpoint hysteresis or band deviation modes.

20. Two control inputs assignable to Meter Reset, Peak & Valley Reset, Peak & Valley Display, Tare, Tare Reset, and Log Trigger.

21. Built-in load cell excitation voltage.

22. Powered by a rechargeable 2400 mAh lithium-ion battery for up to 65 hours of operation. Battery charge monitor circuit with 4-element bar graph charge monitor.

23. Selectable automatic meter shutoff after interval of inactivity (15, 30 or 60 minutes).

24. Wall plug type, UL-rated AC adapter / battery charger unit with removable A-B USB cable.

25. Carrying case (optional).

4. RECEIVING & UNPACKING

Your SSI was carefully tested and inspected prior to shipment. Should your unit be damaged in shipment, keep the shipping materials and notify the freight carrier immediately.

Verify that your SSI shipment includes the following items:

1. **SSI** Smart Sensor Indicator
2. **SSI-USB/ACA** AC adapter / battery charging unit with removable A-B USB cable.
3. **SSI-SCC (2 ea.)** Detachable 3-pin screw-clamp connectors for relay outputs and external controls.
4. **SSI Operator Manual (USB)**
   User manual. Also download from www.transducertechniques.com

Your shipment should also include the following accessories or options if ordered:

1. **SSI-DLS** Data Logging Software
2. **SSI-TRES** TEDS Reader Editor Software
3. **SSI-AMB** Adjustable Mounting Bracket

In the event that your unit is undamaged but is inoperable, return it to your place of purchase for warranty repair or replacement. Please include a detailed description of the problem. See the warranty instructions at the back of this manual.

SSI-USB/ACA
AC adapter with removable A-B USB cable

Six mounting holes in the top plate of the mounting bracket allow meter attachment in two orientations.

The base of the meter has three inserts with 8-32 UNC threads, 3/8” deep, for attachment to the mounting bracket. The inserts are in a triangle pattern with a 1.500” base and 1.750” height.

SSI-AMB Adjustable mounting bracket

SSI-DLS Data Logging Software

SSI-TRES TEDS Reader Editor Software

Available for download from www.transducertechniques.com at no charge:

1. **SSI-IS** Instrument Setup Software.
2. **SSI Operator Manual (USB)** This manual in pdf format.

5. SAFETY CONSIDERATIONS & CARE OF YOUR METER

The SSI is housed in a tough ABS case and is mechanically rugged. The LCD display is protected by a clear Lexan cover. The unit is powered by a rechargeable lithium-ion battery. There are no internal voltages higher than 5V. AC mains power is limited to the input side of a sealed, UL-rated, wall plug AC adapter / battery charger unit.

Warning: Use of this equipment in a manner other than specified may impair the protection of the device and subject the user to a hazard. Visually inspect the unit for signs of damage. If the unit is damaged, do not attempt to operate.

Safety Considerations

- **IMPORTANT:** For AC operation or charging, use **ONLY** the designated AC adapter, **(P/N: SSI-USB/ ACA),** or the supplied A-B USB cable connected to a USB port of a PC.
- Do not plug the AC adapter into an electrical outlet other than 100-240V ac, 50/60 Hz.
- Do not plug the AC adapter into an electrical outlet if the unit is wet or has been damaged, as this could lead to electrical shock and/or equipment damage.
- Do not operate the instrument in the presence of flammable gases or fumes, as such an environment constitutes an explosion hazard.
- Do not operate the instrument if water can get inside the case.
- Do not apply signals to the inputs and outputs other than those specified in this manual.
- Do not operate this equipment without having studied this manual.

Equipment Care

- To maximize battery life, store your meter at room temperature. Avoid storage temperatures below -20°C or above +55°C, as could be found in a parked vehicle.
- Do not drop the instrument. Avoid excessive shock or vibration, which could cause mechanical damage.
- Do not clean the meter with solvents. Instead, use a soft, damp cloth.
- Do not allow water or other fluid into the meter.
- Store the meter in its carrying case when not in use.
- For greatest accuracy, operate the meter at around 25°C, not at temperature extremes.

Operating environment:

The meter is Class II (double insulated) equipment designed for use in Pollution degree 2.

Symbols used


Caution (refer to accompanying documents)


Caution, risk of electric shock.


Earth (ground) terminal.


Equipment protected throughout by double insulation or reinforced insulation.

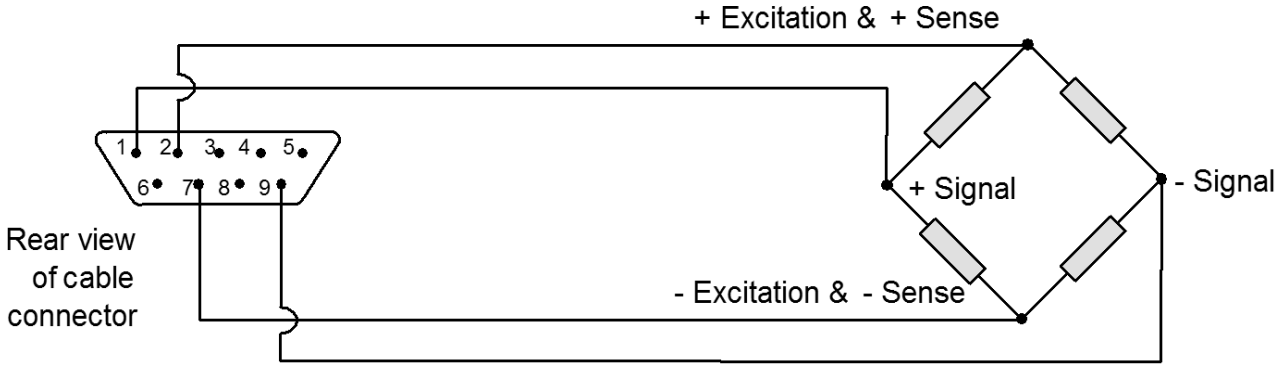

Both direct and alternating current.


CE Mark. Indicates that product meets EU safety, health and environmental requirements.

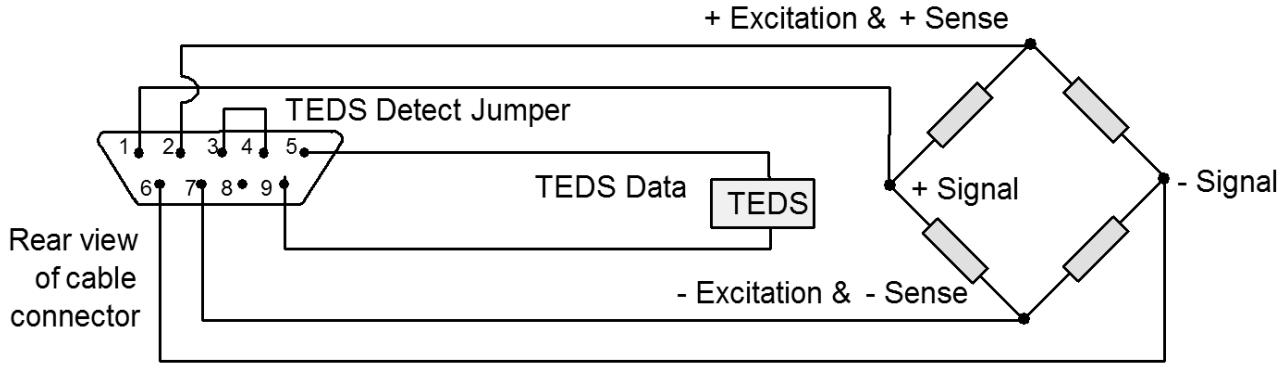
RoHS Symbol. Indicates that product is free from hazardous substances defined in EC directive 2002/95/EC.


WEEE Symbol. Indicates that product should be recycled and not disposed of as general waste.

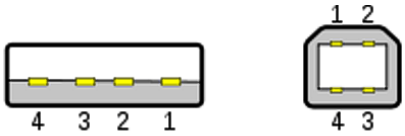
6. CONNECTOR WIRING INFORMATION



Cabling, DB9 at Meter to Non-TEDS Load Cell Assembly



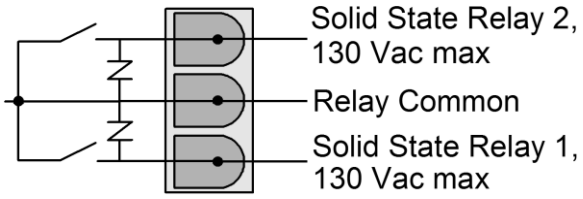
Cabling, DB9 at Meter to TEDS Load Cell Assembly



Type A Type B

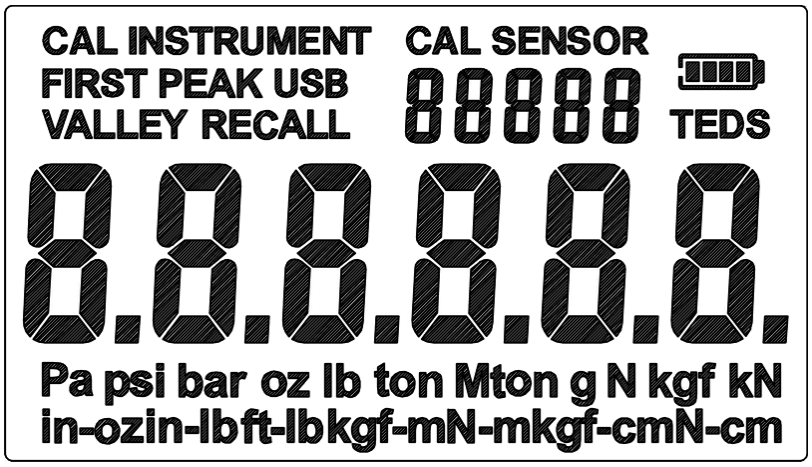
Pin	Name	Description
1	VBUS	+5V
2	D-	Data -
3	D+	Data +
4	GND	Ground

Industry Standard USB Pinout



Relay Jack Pinout (looking into jack)

7. KEYPAD OPERATION



GENERAL

The SSI operator panel consists of an LCD display, an 8-key membrane keypad, and 5 LED indicator lights, as explained below.

LCD DISPLAY

8.8.8.8.8.8.

Main reading. This can be the current reading, recalled reading, first peak, peak, or valley, as selected via the keypad. The numerical reading utilizes 5 digits with leading zero blanking and a selectable decimal point. The 6th left-most digit is used for special applications, such as setting time and date.

Pa psi bar oz lb ton Mton g N kgf KN
in-oz in-lb ft-lb kgf-m kgf N-m kgf-cm N-cm

Unit of measure associated with the main reading. When changed, readings are automatically converted within the same family (load, torque or pressure). In TEDS operation, a default unit of measure is read from EEPROM memory in the TEDS unit at power-up, but can be changed via the keypad.

CAL INSTRUMENT

Flashing indicates either that the instrument is due for calibration or will be due in less than 30 days. Steady indicates that the instrument is now due for calibration.

CAL SENSOR

Flashing indicates either that the sensor is due for calibration or will be due in less than 30 days. Steady indicates that the sensor is now due for calibration.

TEDS Indicates that a TEDS sensor is present, as detected by a jumper across pins 3 and 4 of the DB9 connector, and that plug & play has been selected.

FIRST PEAK Indicates that main reading is First Peak (or first maximum) since last reset.

PEAK Indicates that main reading is the Peak (or maximum) since last reset.

VALLEY Indicates that main reading is the Valley (or minimum) since last reset.

USB Indicates that serial data is being transmitted.

RECALL Indicates that main reading is recalled logged data.

 Battery charge indicator with 4 bars to show percent of full charge. 4 bars = 80% to 100%, 3 bars = 60% to 80%, 2 bars = 40% to 60%, 1 bar = 20% to 40%, flashing battery symbol = 0% to 20%.

8 8 8 8 8 Memory location # from 0 to 15999. Used for data logging or data recall, when these functions are in effect. Indicates FAST for FAST Mode, when a conversion rate faster than the normal 60/second has been selected. When not in the FAST mode, indicates a 10 multiplier when the reading is divided by 10 for a TEDS sensor having a Max Physical Value greater than 100,000.

INDICATOR LIGHTS

- **Top left** (amber): Alarm 1 activated.
- **Top middle** (green): Go (no alarm). Light may be deactivated to conserve power.
- **Top right** (red): Alarm 2 activated.
- **POWER key** (amber): ON when battery is charging, otherwise OFF.
- **LOG key** (green): ON when meter is logging or recalling data, otherwise OFF.

KEYPAD KEYS

POWER Press POWER to turn on the meter. The LCD will come on, and the meter will be in the RUN mode. Press POWER again to turn off. Automatic power shut-off may also occur after a pre-selected fixed interval of non-use (no switches pushed), or this feature may be disabled. Three time intervals are menu-selectable (15, 30 or 60 minutes), as is an optional audible warning 20 seconds prior to shut-off.

UNITS Press UNITS repeatedly in the Run mode to step from one unit of measure to the next within the same family of units. These are available for load (oz, lb, ton, Mton, g, N, kgf, kN), torque (in-oz, in-lb, ft-lb, kgf-m, N-m, kgf-cm, N-cm), or pressure (Pa, psi, bar). Readings are automatically converted within each family as units of measure change. In TEDS operation, a default unit of measure is always read from the transducer at power-up. In non-TEDS operation, units are selected during meter setup, and the last menu-selected unit of measure is recalled at power-up.

Press UNITS in the Recall mode to display the last meter calibration date. Press RECALL to display the previous Recall value.

LOG

From the RUN mode, press LOG momentarily to log the current reading into the next available Memory location # (from 0 to 15999). Press LOG for longer than 2 seconds to place the meter in the Continuous Logging mode, which will log multiple readings at a programmable data collection rate. Press LOG momentarily again to exit the Continuous Logging mode.

The action of the LOG key is menu-selectable. Logging can be disabled, to internal memory only, to USB only, or to both internal memory and USB. Please see Section 8, "Data Logging & Recall Operation."

RECALL

From the RUN mode, press RECALL for longer than 2 seconds to change to the RECALL mode, where previously logged readings can be recalled, as opposed to taking new readings. Press LOG momentarily to recall single logged readings. Press LOG for longer than 2 seconds to recall successive readings continuously. The Memory location # of each recalled reading will be shown in the 88888 field. Press LOG momentarily to terminate the Continuous RECALL mode. Press UNITS in the Recall mode to display the last meter calibration date. Press RECALL to display the previous Recall value. Press RECALL for longer than 2 seconds to return to the RUN mode. Please see Section 8, "Data Logging & Recall Operation."

> MENU

From the RUN mode, Press > MENU to change to the Menu mode, which allows setting up the meter from the keypad. Press > MENU to step through menu items. Press > PEAK to select digits or sub-items within the selected menu item, and press TARE ^ RESET to modify the selected flashing digit or sub-item. The UNITS, RECALL and LOG keys are disabled in the Menu mode. Please see the Menu Mode section of this manual.

The > MENU and < ALARMS keys are also used in the RECALL mode to increment or decrement Memory location #'s (from 0 to 15999) for displaying logged readings.

> PEAK

The action of the > PEAK key is programmable to 4 operating modes, so that pressing it from the RUN mode will display 1) Peak, 2) First Peak, 3) Valley, 4) Peak (1^{st} push) and Valley (2^{nd} push). When Peak, Valley or First Peak is being displayed, the appropriate LCD indicator caption will be displayed (PEAK, VALLEY or FIRST PEAK). Pressing the > PEAK key one more time returns to the RUN mode.

The > PEAK key is also used in the Menu mode to advance the flashing indicator of the menu value, and in the RECALL mode to advance the next flashing digit of the logging Memory location # (0 to 15999).

TARE ^ RESET

To zero the display from the RUN mode, press TARE ^ RESET (selectable Tare function). With no load applied, this action will zero the system. If the meter is used in a weighing application with an empty container, this will subtract the weight of the empty container to display net weight.

To reset the meter, hold the TARE ^ RESET key depressed while you press and release the > MENU key.

To reset a Peak, Valley or First Peak, hold the TARE ^ RESET key depressed while you press and release the > PEAK key.

To reset latched Alarms, hold the TARE ^ RESET key depressed while you press and release the < ALARMS key.

The TARE ^ RESET key is also used in the Menu mode and in the RECALL mode to increment the flashing selection.

< ALARMS From the RUN mode, press < ALARMS to change to the Alarms mode, which allows viewing and changing setpoints from the keypad. Press once to view Setpoint 1. The Alarm 1 indicator (amber LED) will light. Press again to view Setpoint 2. The Alarm 2 indicator (red LED) will light. Press again to exit the Alarms mode and return to the RUN mode. While the Alarm 1 indicator is lit, you can change Setpoint 1 by pressing > PEAK to select a digit, which will flash, then pressing TARE ^ RESET to increment that digit. Same for Setpoint 2.

In the Menu mode, the > ALARMS key steps backward through the menu. In the RECALL mode, it is used to decrement Memory location #'s from 15999 to 0.

TEDS ERROR MESSAGES

If there is a problem with the TEDS connection between the meter and TEDS transducer, one of the following error messages is displayed at power on:

Err 1 - TEDS data line shorted.
Err 2 - No Presence pulse from TEDS.
Err 3 - Improper Presence pulse width.
Err 4 - Error in TEDS family code in ROM.
Err 5 - TEDS checksum error in the first or second 32 bytes.

Correct the problem and then press the Menu key.

8. DATA LOGGING & RECALL OPERATION

1. Modes of Operation

Two modes of operation are associated with logging:

RUN mode: The meter is converting and displaying readings. Logging may or may not be taking place simultaneously.

RECALL mode: The meter is not converting. Previously stored values are displayed on the meter and may be transmitted via USB.

2. Logging & Recall Indicators

Four indicators are associated with logging and recall:

- **Green LED** at the LOG key.
- **5-digit Memory location #** number 88888 on the LCD display (referred to as Memory #).
- **USB indicator** on the LCD display (shows that values are being transmitted).
- **RECALL indicator** on the LCD display (shows that meter is in the RECALL mode).

3. Logging & Recall Key Action

The action of the LOG and RECALL keys depends on the current meter operating mode and the duration of the key push, which can be short (momentary) or long (> 2 seconds). For the purpose of this section, it is assumed that logging to both internal memory and USB has been selected in the Menu mode. If not, one or both of the logging modes is not active, and the USB label or the Memory # does not display.

Up to four Value items can be selected for logging to USB with Normal conversions. These are identified by a Value Type in capital letters: R = Reading, P = Peak, V = Valley, F = First Peak. Up to three Value items can be selected for logging to USB with Fast conversions. These are identified by a Value Type in lower case: r = reading, p = peak, f = first peak.

The displayed value is logged to internal memory along with Date, Time, Units, Value Type, Alarms and Overload Status. These items are selectable for logging or recall to USB.

4. RUN Mode

LOG Key, Short Push

- If Continuous logging is <u>off</u> (Green LED off), a short push of the Log key causes the currently displayed reading and supporting data to be logged once to the current Memory #, and selected data to be transmitted via USB. The Green LED is lit momentarily, while the Memory # and USB label are displayed for 2 seconds.
- If Continuous logging is <u>on</u> (Green LED, Memory # and USB label on steady), a short push of the Log key turns off Continuous logging. The Green LED, Memory # and USB label are turned off.

LOG Key, Long Push

Displayed readings are continuously logged to successive Memory location #'s and to USB at the Menu-selected output rate. The Green LED, the Memory # and USB label remain on continuously.

RECALL Key, Short Push

- If Continuous logging is off, a header record consisting of Date, Time Units and Value Type is transmitted via USB.
- If Continuous logging is on, Continuous logging is turned off.

RECALL Key, Long Push

The meter is put into the RECALL mode.

5. Recall Mode

A Long push of the RECALL key enters the RECALL mode from the RUN mode, and the RECALL label is displayed. The meter no longer takes new readings, but recalls previously stored readings from memory. The Memory # is shown on the 5-digit (88888) display and the value stored at that location is shown on the 6-digit main display. If USB has been selected, the USB label is displayed.

Manual Controls to Change Memory #

Press > MENU to increment the Memory # displayed.

Press < ALARMS to decrement the Memory # displayed.

To set the Memory # directly to a value:

1. Press > PEAK to advance to the next digit of the Memory #. That digit will flash.
2. Press TARE ^ RESET to increment the flashing digit.

When done, press > MENU to save the changed Memory #.

When exiting the RECALL mode and reentering the RUN mode, the next logged data is to the last Memory # being displayed, unless Memory Protect is enabled, in which case the next logged data is to the next Memory # after the highest Memory # with stored data.

The RECALL mode can also be initiated by computer. The main display then shows **dnLoAd**. When this mode is entered, the computer-selected Memory #'s are displayed and transmitted via USB to the computer. When done, the meter is reset to the RUN mode.

LOG Key, Short Push

- If Continuous Recall is **off** (Green LED off): Transmits the displayed value and all other selected non-value data items over USB. Advances the Memory # and displays that stored value.
- If Continuous Recall is **on** (Green LED on): Turns Continuous Recall and the Green LED off. The current Memory # and USB label remain on steady.

LOG Key, Long Push

Transmits the displayed Value and selected non-value data items over USB, then advances the Memory #. This is repeated continuously until the LOG or RECALL key is given a Short push to turn off Continuous Recall. The Green LED, Memory # and USB label remain on during continuous transmission.

RECALL Key, Short Push

- If Continuous Recall is **off** (Green LED off): No effect.
- If Continuous recall is **on** (Green LED on steady): Continuous Recall and the green LED are turned off.

RECALL Key, Long Push

Returns the meter to the RUN mode.

Summary of Key Operations

RECALL Key, Long Push: Toggles between the RUN mode and the RECALL mode.

LOG Key, Short Push: Causes one log or one recall if not in Continuous logging or recall, else turns off continuous logging or recall.

LOG Key, Long Push: Enters Continuous Log or Recall

RECALL Key, Short Push: Sends Header in RUN mode if not in Continuous logging, otherwise turns off Continuous logging or recall.

Erasing Memory

Put the meter in the RECALL mode with a RECALL key long push. Hold down the RECALL key, press RESET, then release both keys within 2 seconds to arm the meter for erasing all memory. The display then shows **ErASE?**. Repeat the same action to erase all memory and reset the Memory # to zero. The display shows **ErSing** while the memory is being erased. Pressing any other key while the display shows **ErASE?** returns the meter to the RECALL mode without erasing the memory.

Storing the Current Memory Location

When the meter is turned off, either by the keypad POWER key or by elapsed time with no switch action, the meter stores the current Memory # and then restores this number when power is reapplied. The current Memory # is not altered by meter Reset.

6. Data Logging

Readings and associated data items can be logged to either internal memory only, to USB only, or to both simultaneously. Single-record logging can be achieved with a short push of the LOG key. Continuous logging can be initiated by holding down the LOG key until an audible signal is heard (approximately 2 seconds).

Logging to Internal Memory

For each logged record, all of the non-Value data items are stored in memory plus the Displayed Value, which might be either the Reading, Peak, Valley or First Peak value as selected by the user. The second table below lists all of the data items. If Memory Protect is enabled, any attempt to log to a selected memory location containing data will be redirected to the next location following the highest location written. If Memory Protect is disabled, any selected memory location can be overwritten.

Logging to USB

For more detailed information, download the SSI Serial Communications Manual from the www.transducertechniques.com website.

For each logged record, only the selected data items are transmitted via USB. All of the non-Value data items are optional, but the Value selection made from the menu item SEr_3, Digit 5 as shown below is always included.

Ser_3, Digit 5	Value 1	Value 2	Value 3
0	Reading		
1	Peak		
2	Valley		
3	Reading	Peak	
4	Reading	Valley	
5	Reading	Peak	Valley
6	Displayed		

Logging Rate

When logging only to internal memory, the continuous logging rate is determined by the data output rate, SEr_1, Digit 5. When logging only to USB or to both internal memory and USB, the logging rate is determined by three factors:

1. The data output rate setting (SEr_1, Digit 5).
2. The baud rate (SEr_1, Digit 4).
3. The number of data bytes to be transmitted per record via USB (see table below).

For example, when the data output rate is selected to be 60/second, the actual logging rate may be less depending on the baud rate and number of data bytes per record. When the data output rate is 3.8/second or slower and the baud rate is 2400 or higher, the number of data bytes per record does not affect the output rate.

Up to 3 Values, 6 data items and a line feed can be individually selected to be included in the data stream, each adding to the total number of data bytes to be transmitted per

record via USB. The minimum number of bytes per record is 8 (1st Value only). The maximum number of bytes per record is 59 (all selected).

Data Items & * Values	Stored in Memory	USB Selection	Bytes
* Memory #	Implied	LoG, Digit 3	5
* Date	Yes	LoG, Digit 2	9
* Time	Yes	LoG, Digit 2	9
Value 1	Only if displayed	SEr_3, Digit 5	8
Value 2	Only if displayed	SEr_3, Digit 5	7
Value 3	Only if displayed	SEr_3, Digit 5	7
* Units	Yes	LoG, Digit 1	5
* Value Type	Yes	LoG, Digit 1	4
* Alarms, Overload	Yes	SEr_2, Digit 3	3
Line Feed	No	SEr_2, Digit 2	2

For a selected data output rate of 60/second, the maximum number bytes per record that are allowed to achieve the specified logging rates are listed for each baud rate shown:

Baud Rate	Maximum data bytes transmitted at specified logging rate						
	60/sec	55/sec	30/sec	20/sec	15/sec	12/sec	10/sec
38400	47	51	59	59	59	59	59
19200	26	26	56	59	59	59	59
9600	12	14	29	43	59	59	59
4800			15	23	30	37	47

When logging only to internal memory and not to serial communications, the above timing constraints do not apply, and the logging rate is determined by the data output rate. Also, the Data Items logged to memory and available for recall always include the Displayed Value (which can be the Reading, Peak or Valley Value) plus all other non-value Data Items.

Alternate Logging Method

In the RUN mode, continuous data can be sent at every output rate by setting SEr_2, Digit 4 to 0. The only data sent are the Values selected by SEr_3, Digit 5 and the optional alarms and line feed.

7. Data Recall

- **Data Logging Software (P/N SSI-DLS)** is available from www.transducertechniques.com for download. This software is needed to recall stored data from the meter. It lists, plots or stores meter data in PC memory.
- **Recall initiated by the Log key or a control input while in the RECALL mode.** The meter sends the Memory # and stored Value to the display. The meter sends the USB data item selections via USB, except that the Value stored in Memory is substituted for the USB Value selection.
- **Recall by computer command with the meter in either the RUN or RECALL mode.** The computer command sends the starting Memory # and number of memory locations to be read. Meter displays “dnLoAd” and responds with the USB data items selections via USB, except that the Value stored in Memory is substituted for the USB Value selection. The meter resets when the recall is done.

9. MENU MODE PROGRAMMING FUNDAMENTALS

1. Overview

Menu Mode programming utilizes the middle row of four keypad keys labeled > MENU, > PEAK, TARE ^ RESET, and < ALARMS.

- Pressing > MENU enters the Menu Mode.
- Pressing > MENU repeatedly steps through all unlocked menu items.
- Pressing > PEAK for a given menu item displays the selection value. The current choice flashes and is subject to change.
- Pressing > PEAK repeatedly advances through all available choices for that menu item.
- Pressing TARE ^ RESET while a digit is flashing increments that digit. Please see Section 10, “Menu Mode Programming Keystrokes,” for the meaning of each digit. If a polarity sign is associated with the first digit, the key action increments through all positive values, then through all negative values.
- Pressing > PEAK after incrementing a digit moves on to the next digit and saves digit changes temporarily in the meter’s RAM.
- Pressing > MENU again enters the final value in the meters non-volatile EEPROM memory. The word “StorE” appears briefly.
- Pressing < ALARMS goes back to the previous menu item.

Any of the menu items can be locked out, or skipped, by changing appropriate lockout digits from 0 to 1 under menu items Loc_1 through Loc_4. Skipping menu items that are only used for initial meter setup has the advantage of simplifying meter operation and reducing the chance of inadvertent setup changes. If an expected menu item does not appear, always look for 1’s among the lockout digits before calling the factory for help.

Also note that menu items do not appear if they are not applicable to the meter’s specific configuration. For example, menu items related to scaling do not appear if TEDS operation is in effect, and TEDS related menu items do not appear if TEDS Plug-and-Play operation has been disabled.

The alternative to Menu Mode programming is to use *SSI Instrument Setup* software, a Windows application that runs on PC which is connected to the meter via USB. This software is available for download. Please see Section 11, “Instrument Setup Via PC.”

2. Conversion Rate

Eight conversion rates are selectable, consisting of one “Normal” and seven “Fast.”

- **The Normal rate** is 60 (60 Hz noise rejection) or 50 (50 Hz noise rejection) conversions per second. Each conversion consists of the average of 256 samples. The sample rate is 15,360 samples/second for 60 Hz and 12,800 samples/second for 50 Hz..

- **Fast rates** can be set in binary steps from 2X to 128X Normal with the same sample rate as Normal but fewer samples averaged per conversion. A Fast rate selection is indicated by “FASt” on the small 5-digit display (88888).

3. Meter Scaling

Scaling converts signal inputs in mV to decimal readings in engineering units.

The meter is automatically scaled at power-up when connected to a TEDS transducer with the appropriate cable. A primary unit of measure (for load, torque or pressure) is retrieved from the TEDS unit, but can be changed from the keypad by pressing UNITS. Displayed readings are then automatically converted. If the maximum physical value stored in TEDS exceeds 100000, it is divided by 10, and a 10 multiplier appears in the small digital display.

Two scaling methods are selectable under SEtuP for non-TEDS transducers:

The “Coordinates of 2 Points” scaling method can be used with non-TEDS transducers when physical input signals are not available. With this method, (Lo in, Lo rd) and (Hi in, Hi rd) data points are entered numerically and appear near the middle of the menu items.

The “Reading Coordinates of 2 Points” scaling method can be used with non-TEDS transducers when actual input signals are available. This method has the advantage of scaling the load cell and meter as a system, and voltage values do not need to be known. An actual “Lo in” signal, such as the output of a load cell at zero load, and “Hi in” signal, such as the output of the same load cell at a known high load, are applied to the meter. The desired corresponding Lo Rd, Hi Rd and HiEnd values are entered from the keypad. The HiEnd value is the high end reading of the span over which the load cell is expected to operate. The display will flash overload when the reading reaches the High End value +20% of span (HiEnd - Lo Rd). If this scaling method is selected, the six related menu items, which include selection of the unit of measure, will appear ahead of all other menu items.

4. Decimal Point Selection

The decimal point is user selectable under dEC.Pt, but acts differently in TEDS and non-TEDS operation. In TEDS operation, it relates to the reading. For example, the same weight reading in grams can be displayed in integer grams only or be followed by one, two or three decimals. In non-TEDS operation, the decimal point is independent of the numerical reading in counts, so that the reading can be in different units. For example, by moving the decimal point from left to right, the same weight could be displayed with the same resolution and accuracy in hectograms, decagrams, grams, decigrams, centigrams or milligrams. If TEDS is connected and Plug & Play is enabled, the decimal point is obtained from TEDS and not the meter. The meter displays **tEdS** instead of **StorE** for a stored change.

5. Noise Filtering

Since electrical noise is often a factor with millivolt signals, the SSI offers programmable features so that a user can make the best compromise between noise rejection and meter response rate for the application and noise environment. Note: Nois**e filtering is only available at Normal conversion rates of 60 or 50 Hz.**

The first selection under the SEtuP menu item is for 60 or 50 Hz noise environments. This sets the basic conversion rate of the meter to a full line cycle at 60 or 50 Hz, so as to cancel out the positive and negative components of AC line noise pickup for any conversion.

A value called "filtered value" is listed under the FiLtr menu item. This value can then be assigned to the Displayed reading and hence logged reading, to Alarms, and to Peak & Valley. Choices for the filtered value are the following:

- **Batch average of 16 conversions.** The filtered values are independent of each other and are updated every 267 ms (60 Hz) or 320 ms (50 Hz).
- **Moving average filter.** The equivalent RC time constants are listed in Section 10, FiLtr, Digit 5. Regardless of the filter method, the meter display is always updated every 16 conversions (3.75 times/second at 60 Hz, 3.125 times/second at 50 Hz) because this is a good update rate for the human eye.
- **Autofilter moving average filter**. In this mode, the meter automatically selects the best moving average time constant for the encountered noise condition.

Adaptive filter operation is always functional with moving average filters. This means that the filter automatically resets the moving average to the current reading when a significant step in the signal is encountered. With adaptive filtering, the meter can respond rapidly to meaningful changes in signal level, while filtering out random noise. Two adaptive filter thresholds are selectable: Low and High. Low should normally be selected, while High should be selected if high noise transients are expected.

Zero setting (ZEro menu item) can set the meter reading to zero when the signal level is below a specified percentage of full scale. This avoids meaningless noise readings when the reading should be zero.

6. Peak, Valley, First Peak, Fast Peak

With the Normal conversion rate, as set up under the SEtuP menu item, Peak, Valley and First Peak can be based on the Filtered or Unfiltered value, as selected under the FiLtr menu. The displayed reading in response to pressing the > PEAK key then can be Peak, First Peak, Valley, or Peak (1st push) and Valley (2nd push), as selected under the ConFG menu. Any combination of the current Reading, Peak/First Peak or Valley can be data logged to a computer via serial communications along with time and date, as selected under the SEr_3 menu. However, the displayed reading is the only time and date tagged item logged to internal memory.

With a Fast conversion rate, as set up under the SEtuP menu, the much faster Fast Peak and First Peak capture modes apply, and all filtering is disabled. When the 128 x Normal conversion rate is selected, the meter can capture Fast Peaks as fast as every 130 µs. Polarity of the Fast Peak is pre-selected to be positive or negative under the ConFG menu.

Reset for all Peak and Valley related items is achieved by holding the TARE ^ RESET key depressed while momentarily pressing > PEAK.

7. Alarms

The SSI includes two solid state alarm relays rated 110 mA @ 350V peak, 35 ohms series resistance. There is a common contact for the two relays. The active state of alarms is shown by LED indicators: amber for Alarm 1, red for Alarm 2, and green for “Go” with no alarm active. The “Go” LED can be disabled under the ALErt menu to conserve power.

With the Normal conversion rate, the relays can respond to the Unfiltered or Filtered value, as selected under the FiLtr menu, to avoid triggering on electrical noise. The number of consecutive readings in the alarm zone required to actuate the alarm is selectable in binary steps from 1 to 128 (ALSet menu item) to avoid actuating on transients.

The action of the two relays is individually programmable with the ALSet menu item. Each relay can be set to ON or OFF when the corresponding alarm is active, to be latching or non-latching, to activate above or below the setpoint, and to operate with hysteresis or band deviation.

- **Hysteresis,** set under the dEU1H and dEU2H menus, controls alarm action symmetrically around a setpoint. A high active alarm activates when the reading goes above the setpoint by the hysteresis value and de-activates when the reading falls below the setpoint by the hysteresis value. A narrow hysteresis band can be used to minimize relay chatter around a setpoint due to electrical noise or signal feedback caused by load switching. A wide hysteresis band can be used for control applications. The hysteresis band is twice the hysteresis value.
- **Band deviation,** set under the dEU1b and dEU2b menus, controls alarm action symmetrically around a setpoint to create a passband. A high active alarm activates when the reading falls outside the deviation band, and de-activates when the reading falls inside. A deviation value is set up around both sides of the setpoint to create a pass band. Band deviation is often used in QA applications to pass or reject parts. The deviation band equals twice the deviation value.

8. Keypad Lockouts

Many of the menu items can be locked out, or skipped, by changing appropriate lockout digits from 0 to 1 under menu items Loc_1 through Loc_4. Skipping menu items that are only used for initial meter setup has the advantage of simplifying meter operation and reducing the chance of inadvertent setup changes. If an expected menu item does not appear, always look for 1’s among the lockout digits before calling the factory for help.

9. External Control Inputs

By shorting one or both control inputs A and B to ground (see Section 6), the following items can be externally commanded: Log, Tare, Tare Reset, Peak, Valley, Peak then Valley, Function Reset, Meter Reset. These functions are also available from the keypad unless locked out.

10. Calibration Due Indicators

The flashing CAL INSTRUMENT indicator appears on the display when instrument calibration is due. This indicator starts flashing 30 days before the due date as a warning. To acknowledge this warning and turn off the flashing indicator, select the menu item CALrt and change the first digit from a 1 to a 0. The CAL INSTRUMENT indicator will disappear until the 30-day period has expired, after which it will reappear as a steady indication. Once it has started flashing, the CAL INSTRUMENT indicator will continue to flash until it is acknowledged, even if the 30 days are exceeded.

The CAL SENSOR indicator functions the same, except that it is acknowledged by changing the second digit of CALrt from a 1 to a 0. The operation applies to the TEDS sensor that is actively connected to the SSI unit. If a TEDS sensor is not connected or Plug and Play is not selected, the CAL SENSOR indicator does not appear

10. MENU MODE PROGRAMMING KEYSTROKES

The five menu items on this page will appear first when the > MENU key is first pressed from the RUN mode if the following conditions apply:

1. The transducer is a non-TEDS transducer or a TEDS transducer where Plug & Play operation has been disabled.
2. The "Reading Coordinates of 2 Points" scaling method has been selected under *SEtuP*.
3. Custom curve linearization has not been selected.
4. If a menu item does not appear, please see "Keypad Lockouts" in Section 9 and the Loc_1 to Loc_4 digit details at the end of the current section.

The numbers in the five rows below are examples for a 0-100 lb load cell at 2 mv/V calibrated at 50 lbs.

> MENU Key	Press > PEAK Key	Press TARE ∧ RESET Key
Lo In Apply low signal input (e.g., load cell output for 0.00 lbs).	**0.02** Press > PEAK to display reading at low signal input.	**0.02** Press TARE ∧ RESET to store low reading.
Hi In Apply high signal input (e.g., load cell output for known 50.00 lbs).	**3.03** Press > PEAK to display reading at high signal input.	**3.03** Press TARE ∧ RESET to store high reading.
Lo rd Enter desired reading at low signal input (e.g., 0.00).	**0**00.00 0**0**0.00 00**0**.00 000.**0**0 000.0**0** Select digit to flash.	**0.00** Select **-9** thru **9** for flashing 1st digit, **0** thru **9** for other flashing digits.
Hi rd Enter desired reading at high signal input (e.g., 50.00).	**0**00.00 0**0**0.00 00**0**.00 000.**0**0 000.0**0** Select digit to flash.	**50.00** Select **-9** thru **9** for flashing 1st digit, **0** thru **9** for other flashing digits.
HiEnd Enter desired reading for high end of span (e.g., 100.00).	**0**00.00 0**0**0.00 00**0**.00 000.**0**0 000.0**0** Select digit to flash.	**100.00** Select **-9** thru **9** for flashing 1st digit, **0** thru **9** for other flashing digits.
UnitS Select unit of measure.	**none**	No unit of measure
	LoAd Units of load	**oz** Ounce **lb** Pound **ton** U.S. ton (2,000 lbs) **Mton** Metric ton (2,204.62 lbs) **g** Gram **N** Newton **kgf** Kilogram **kN** KiloNewton

	torque Units of torque	**In-oz** Inch-ounce **In-lb** Inch-pound **ft-lb** Foot-pound **kgf-m** Kilogram-meter **N-m** Newton-meter **kgf-cm** Kilogram-centimeter **N-cm** Newton-centimeter
	PrESSr Units of pressure	**Pa** Pascal **psi** Pounds per sq. inch **bar** Bar
SEtuP First set of meter setup functions.	**0**_00 Noise rejection	**0** 60 Hz environment **1** 50 Hz environment
	0_**0**0 Scaling method	**0** Not used **1** Coordinates of 2 points **2** Reading coordinates of 2 points
	0_0**0** Action of external control inputs A & B, or simultaneous inputs A & B. * Display Peak or Valley as selected under ConFG. *Funct Reset* resets Peak, Valley & Latched Alarms.	**Ctrl Input A** / **Ctrl Input B** / **Both** **0** Meter reset / Funct. reset / Meter **1** Meter reset / Pk or Vy* / Meter **2** Meter reset / Tare / Meter **3** Meter reset / Log / Meter **4** Funct. reset / Pk or Vy* / Meter **5** Funct. reset / Tare / Meter **6** Funct. reset / Log / Meter **7** Pk or Vy* / Tare / Funct **8** Pk or Vy* / Log / Funct **9** Tare / Log / Funct **A** Tare / Tare reset / Funct **B** Valley / Peak / Funct
ConFG Second set of meter setup functions.	**0**0000 Conversion rate Rates are shown for 60 Hz environment. Divide by 1.2 for 50 Hz. See Section 15 (Specifications) for corresponding internal noise levels in µV.	**0** 60 conversions/sec (Normal rate) **1** 120 conversion/sec (Fast rate) **2** 240 conversion/sec (Fast rate) **3** 480 conversion/sec (Fast rate) **4** 960 conversion/sec (Fast rate) **5** 1,920 conversion/sec (Fast rate) **6** 3,840 conversion/sec (Fast rate) **7** 7,680 conversion/sec (Fast rate)

	0**0**000 Displayed value in response to pressing the > PEAK key.	**0** Peak (Normal or Fast rate) **1** First Peak (Normal or Fast rate) **2** Valley (Normal rate only) **3** Peak (1st push), Valley (2nd push) (Normal rate only)
	00**0**00 Peak polarity. Applies only to Fast conversion rates.	**0** Positive Peak **1** Negative Peak
	000**0**0 Signal polarity	**0** Normal **1** Reversed
	0000**0** Custom curve linearization. Normal rate only.	**0** Linear input **1** Custom curve
FiLtr Filter setup Applies to Normal operation at 60 or 50 Hz. The display is always updated every 16 conversions.	**0**0000 Alarm source	**0** Unfiltered value (1 conversion) **1** Filtered value
	0**0**000 Peak, Valley, First Peak source	**0** Unfiltered value (1 conversion) **1** Filtered value
	00**0**00 Displayed reading	**0** Batch average of 16 conversions **1** Filtered value
	000**0**0 Adaptive filter threshold	**0** Low (normal setting) **1** High (large transients expected)
	0000**0** Filtered value. Can be applied to 0 reading, serial data output, alarms, Peak & Valley.	**0** Auto filter selects time constant **1** Batch average of 16 conversions **2** Moving avg time const = 0.08 sec **3** Moving avg time const = 0.15 sec **4** Moving avg time const. = 0.3 sec **5** Moving avg time const = 0.6 sec **6** Moving avg time const = 1.2 sec **7** Moving avg time const = 2.4 sec **8** Moving avg time const = 4.8 sec **9** Moving avg time const = 9.6 sec **A** No filter. "Displayed reading" must be set to 1 (Filtered value).
dEC.Pt System decimal point *	dd.ddd Decimal point flashes.	.ddddd d.dddd dd.ddd ddd.dd dddd.d ddddd.

* If TEDS is connected and Plug & Play is enabled, the decimal point is obtained from TEDS and not the meter. When changed, the meter displays **tEdS** instead of **StorE**.

The next 5 menu items are for the “Coordinates of 2 Points” scaling method if selected under SEtuP. The more popular “Reading Coordinates of 2 Points” scaling method will appear at the beginning of the menu items if selected under SEtuP. Neither scaling method will appear if custom curve linearization is selected or if TEDS Plug & Play is active.

> MENU Key	Press > PEAK Key	Press TARE ∧ RESET Key
Lo In Low signal input	**0**0.000 0**0**.000 00.**0**00 00.0**0**0 00.00**0** Select digit to flash.	Select **-9** thru **9** for flashing 1st digit, **0** thru **9** for other flashing digits. Decimal point for Lo Rd, Hi Rd is set by dEC.Pt.
Lo Rd Desired reading at low signal input		
Hi In High signal input		
Hi Rd Desired reading at high signal input		
UnitS Units of measure	Same selections as for “Reading Coordinates of 2 Points” scaling method, shown at beginning of menu items.	

Press > MENU Key	Press > PEAK Key	Press TARE ∧ RESET Key
Trig Trigger level	**0**0 First Peak If a peak has been found and the reading drops by this % of span, the peak is captured as First Peak.	**1** 1% of span **6** 6% of span **2** 2% of span **7** 7% of span **3** 3% of span **8** 8% of span **4** 4% of span **9** 9% of span **5** 5% of span
	0**0** Zero width Values less than this % of span will read 0.	**0** None **2** 1% of span **1** 0.5% of span **3** 2% of span Select “None” if zero reading occurs other than at one end of measurement range.
Rd0 Offset applicable to custom curve linearization only	**0**0.000 0**0**.000 00.**0**00 00.0**0**0 00.00**0** Select digit to flash.	Select **-9** thru **9** for flashing 1st digit, **0** thru **9** for other flashing digits. Decimal point is set by *dEC.Pt.*
ALSEt Alarm Setup	**0**0000 Relay state when alarm is active.	**0** Relay 1 ON Relay 2 ON **1** Relay 1 OFF Relay 2 ON **2** Relay 1 ON Relay 2 OFF **3** Relay 1 OFF Relay 2 OFF

	0**0**000 Relay reset mode: non-latching (auto-reset), latching (requires manual reset).	**0** AL1 non-latch AL2 non-latch **1** AL1 latching AL2 non-latch **2** AL1 non-latch AL2 latching **3** AL1 latching AL latching
	00**0**00 Active alarm state: active high (at or above setpoint), or active low (at or below setpoint).	**0** AL1 active high AL2 active high **1** AL1 active low AL2 active high **2** AL1 disabled AL2 active high **3** AL1 active high AL2 active low **4** AL1 active low AL2 active low **5** AL1 disabled AL2 active low **6** AL1 active high AL2 disabled **7** AL1 active low AL2 disabled **8** AL1 disabled AL2 disabled
	000**0**0 Hysteresis mode or band deviation mode.	**0** AL1 band dev. AL2 band dev. **1** AL1 hysteresis AL2 band dev. **2** AL1 band dev. AL2 hysteresis **3** AL1 hysteresis AL2 hysteresis **4** No dev or hysteresis in menu
	0000**0** Number of readings in alarm zone required to actuate an alarm.	**0** 1 reading **4** 16 readings **1** 2 readings **5** 32 readings **2** 4 readings **6** 64 readings **3** 8 readings **7** 128 readings
dEU1H Alarm 1 hysteresis **dEU2H** Alarm 2 hysteresis **dEU1b** Alarm 1 band deviation **dEU2b** Alarm 2 band deviation	**0**0000 0**0**000 00**0**00 000**0**0 0000**0** Select digit to flash.	Select **-9** thru **9** for flashing 1st digit, **0** thru **9** for other flashing digits. High active alarms will activate above or below setpoint by value entered (half of hysteresis band or deviation band).
tArE Tare or TEDS operation. TEDS indication cannot be disabled in TEDS Plug & Play mode.	**0**0_0 Keypad tare	**0** Enabled **1** Disabled
	0**0**_0 Auto-tare	**0** Enabled **1** Disabled
	00_**0** TEDS operation. Can only be changed when TEDS is detected, otherwise = 1.	**0** Enabled **1** Disabled

SEr_1 Serial Config 1 Fixed Parameters: No parity 8 data bits 1 stop bit * Filtered is not available for Fast conversion rates.	**0**00 Sent value source	**0** Unfiltered* **1** Filtered
	0**0**0 Serial baud rate	**0** 300 baud **4** 4800 baud **1** 600 baud **5** 9600 baud **2** 1200 baud **6** 19.2 kbaud **3** 2400 baud **7** 38.4 kbaud
	00**0** Output rate Rates shown are for 60 Hz. Divide by 1.2 for 50 Hz. Selection **0** is line frequency. Selection **1** is normal display interval.	**0** 60/sec **8** 1/34 sec **1** 3.8/sec **9** 1/68 sec **2** 1.9/sec **A** 1/137 sec **3** 0.94/sec **B** 1/273 sec **4** 1/2.1 sec **C** 1/546 sec **5** 1/4.3 sec **D** 1/1092 sec **6** 1/8.5 sec **E** 1/2185 sec **7** 1/17 sec **F** 1/4369 sec
SEr_2 Serial Config 2	**0**00_ <LF> character	**0** No <LF> following <CR> **1** <LF> following <CR>
	0**0**0_ Serial alarm data	**0** No alarm data appended **1** Alarm data appended
	00**0**_ Operating mode	**0** Continuous mode **1** Command mode
SEr_3 Serial Config 3	**0**0 Serial termination characters for multiple items	**0** At end of all items. **1** At end of each item. If Alarm data, only at end.
	0**0** Serial data sent	**0** Reading **1** Peak **2** Valley **3** Rdg + Peak **4** Reading + Valley **5** Reading + Peak + Valley **6** Displayed Value
CALrt Cal Reset. Set to 1 by program when calibration is due in 30 days and CAL caption has started flashing. Manually set to 0 to disable flashing	**0**0 CAL INSTRUMENT	**0** CAL INSTRUMENT not flashing **1** CAL INSTRUMENT flashing
	0**0** CAL SENSOR	**0** CAL SENSOR not flashing **1** CAL SENSOR flashing

LoG Data Logging. Items logged to Memory are Displayed value, Date, Time, Units, Value Type, Alarms, and Overload. Items logged to USB are selectable to conserve bandwidth.	**0**0000 Units of measure and Value Type logged via serial communications.	**0** Do not send Units or Value Type. **1** Send Units, not Value Type. **2** Send Value type, not Units. **3** Send both Value type and Units.
	0**0**000 Time and Date logged via serial communications.	**0** Don't send Time or Date. **1** Send Time, not Date. **2** Send Date, not Time. **3** Send both Date and Time.
	00**0**00 Memory # logged via serial communications.	**0** Don't send Memory **#** address. **1** Send Memory # address.
	000**0**0 Memory Protect to prevent overwriting.	**0** Memory Protect enabled. **1** Memory Protect disabled.
	0000**0** Logging destination and serial Recall selections.	**0** Logging disabled. **1** Log to Memory only. **2** Log to serial only. Serial Recall. **3** Log to both Memory & serial. Serial Recall.
ALErt Visual and audio alerts. 4 digits only.	**0**000 Audio for alarms	**0** Enabled **1** Disabled
	0**0**00 Green Alarm light	**0** Enabled **1** Disabled
	00**0**0 Audio warning before auto power-off	**0** Enabled **1** Disabled
	000**0** Non-use power-off interval	**0** Disabled **2** 30 min **1** 15 min **3** 60 min
time Set time of day	**0**0.00.00 0**0**.00.00 00.**0**0.00 00.0**0**.00 00.00.**0**0 00.00.0**0** Select digit to flash.	Select **0** thru **9** for flashing digit to set time in 24-hour format: 23.59.59
dAtE Set date		Select **0** thru **9** for flashing digit to set date in MM.DD.YY format.

The 6 menu items below are read from the TEDS transducer and are read-only.	
SEr_no	Serial number of transducer. Up to 8 digits in two groups of digits.
Units	Unit of measure, same as on LCD display.
CALdat	Calibration date in MM.DD.YY format.
CALInL	Initials of the person who performed calibration.
CALPer	Calibration period in days.
M-Id	Measurement ID. Choices are A, B or C for the bridge used for calibration.

When a menu item is “locked out,” it does not appear on the menu when pressing the > MENU key. This simplifies operation and minimizes the possibility of inadvertent setup changes.

Press > MENU	**Press** > PEAK	**Press** > PEAK Change digit from **0** to **1** to lock out menu item(s).
Loc_1 Lockout 1	**0**0000	Units (non-TEDS)
	0**0**000	SEtuP, ConFG, dEC.Pt
	00**0**00	FiLtr, triG
	000**0**0	Lo In, Hi In, rd0 (items used for non-TEDS scaling)
	0000**0**	Lo Rd, Hi Rd, HiEnd (items used for non-TEDS scaling)
Loc_2 Lockout 2	**0**000	ALSEt, dEU1H, dEU2H, dEU1b, dEU2b (alarm configuration)
	0**0**00	Change alarm setpoints from keypad
	00**0**0	tArE, LoG, ALErt, timE, dAtE, CALrt
	000**0**	SEr_1, SEr_2, SEr_3
Loc_3 Lockout 3	**0**000	View Peak & Valley by pressing keypad keys.
	0**0**00	View alarm setpoints by pressing keypad keys.
	00**0**0	Reset Peak & Valley from keypad.
	000**0**	Reset meter from keypad.
Loc_4 Lockout 4 Appears for TEDS trans-ducers only	**0**0000	View SEr_no (serial number)
	0**0**000	View Units (unit of measure)
	00**0**00	View CALdat (calibration date)
	000**0**0	View CALInL, M-Id (calibration initials, measurement ID)
	0000**0**	View CALPer (calibration period)

11. INSTRUMENT SETUP & DATA DISPLAY VIA PC

SSI Instrument Setup is a PC program that greatly facilitates meter setup whether the meter is or is not connected to a PC:

- **Connected use** allows uploading, editing and downloading of setup data and execution of commands under computer control. Connected use also allows the display of real-time meter data on the PC.
- **Unconnected use** provides a printable display of menu selections for easy keypad setup.

SOFTWARE INSTALLATION

Download *SSI Instrument Setup* from www.transducertechniques.com onto your PC. Double-click on the downloaded file to unzip it into a special directory, such as *c:\Program Files\SSI\IS*. Within that directory, double-click on *setup.exe*, which will install the software on your PC. Prerequisites for connected use are the following:

- SSI meter
- PC-compatible computer with available USB COM port.
- Standard A-B USB cable to connect the meter and PC.
- *SSI Instrument Setup* software.

ESTABLISHING COMMUNICATIONS

To connect the SSI to a computer, use the supplied A-B USB cable. The computer will display “Found new Hardware” followed by “Welcome to the Found new Hardware Wizard.” Follow the instructions for software installation from a CD.

When the installation is complete, use Device Manager to determine the assigned COM port. To get to Device Manger, go to the Windows Control Panel, click on System, click on the Hardware tab, then click on Device Manager. Go down the device list and click on Ports (COM & LPT) and USB serial port (COM #). Note the COM port # for use with communications to your meter, then exit Control Panel. If you later need to change the COM port, right-click on USB serial port (COM #), then on Properties, Port settings, and Advanced. Change port to the desired number, click OK, then exit Control Panel.

MENU KEY	S	1	2	3	4	5
SEtuP			0		1	0
ConFiG		0	0	0	0	0
FiLtEr		0	0	0	1	4
DecPt		d	d	d	d	d.
Lo In		0	0.	0	0	0
Lo rd		0	0	0	0	0
Hi In		0	6.	0	0	0
Hi rd		5	0	0	0	0
Units-Load			o	z		
Zero						0
AL SEt		0	0	0	0	0
dEUn1b		0	0	0	0	0
dEUn2b		0	0	0	0	0
Tare			1	1		
SEr 1				0	6	0
SEr 2			1	1	1	
SEr 3					0	0
Log		3	3	1		3
Alert		1	1	1	1	0
Time	1	4.	0	2.	3	1
Date	0	5.	0	8.	0	7
Loc 1		0	0	0	0	0
Loc 2			0	0	0	0
Loc 3			0	0	0	0

Connect the meter to the PC. Apply power, and keep the meter in RUN Mode. To start the software from Windows, click on *Start* > *Programs* > SSI Smart Sensor Indicator > SSI *Instrument Setup*. Select the proper COM port and baud rate. Click on *USB* > *Establish*. The program will set the selected COM port to the required baud rate, parity, data bits and stop bit. Once communications have been established, click on *Main Menu*.

SETUP & FILE SHARING WITH A CONNECTED METER

A meter setup file can easily be created or edited on the PC, be saved to disk, and be downloaded via USB into the meter with no keypad programming -- a major time savings when multiple meters have to be set up in the same way.

The best way to learn *SSI Instrument Setup* is to experiment with it. From the *Main Menu*, click on *Meter* > *Get Setup* to retrieve the existing setup data from the meter. Click on *View* > *Setup* to bring up a tabbed setup screen, which will allow you to easily edit the setup parameters using pull-down menus and other selection tools. You can save your selections to a disk file by clicking on *File* > *Save Setup*. You can download your edited file to the meter by clicking on *Meter* > *Put Setup*.

With the meter connected, a *Commands* pull-down menu allows you to execute certain meter functions by using your computer mouse. You can reset individual meter functions, and display current, peak or valley readings.

MENU DISPLAY WITH A CONNECTED METER

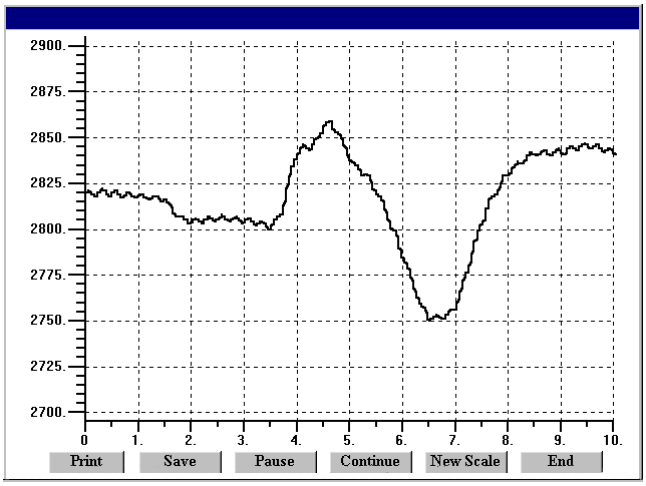
After performing a *Menu* > *Get Setup* from the Main Menu, select *View* > *Menu*. Shown on the computer screen will be the sequential menu items and associated values to be displayed on the meter when stepping through the menu with the keypad.

- Click on any row on the computer screen to bring up a detailed help window for that menu item.
- Click on *Print* for a hardcopy, which you can then use for your records and as a convenient roadmap for programming the meter via its keypad.

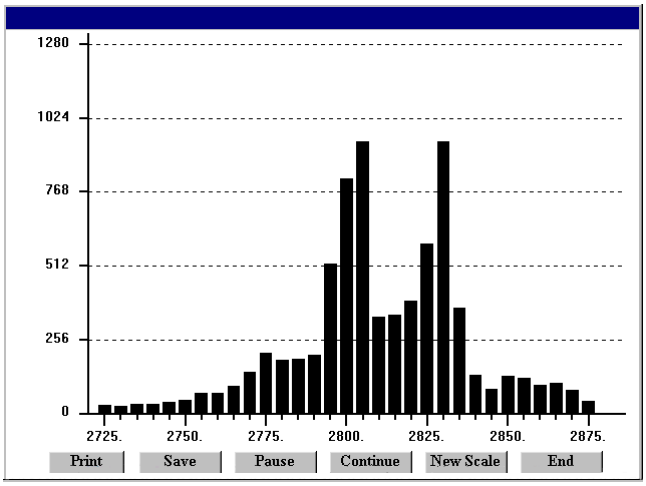
MENU DISPLAY WITH NO METER CONNECTION

SSI Instrument Setup software is also an aid to meter programming when the meter is not connected to the PC. Upon launching the software, click on *None*. From *File*, click on *Default Setup*. Then click on *View* > *Setup*. Make all of the screen selections as if connected to a meter. When done, press on *Main Menu*, then on *View* > *Menu*. The selections made under *Setup* will now be shown on the computer screen, as illustrated on the previous page.

REAL-TIME DATA DISPLAY WITH A CONNECTED METER



Plot



Graph

From the *Main Menu*, click on *Readings.* A pull-down menu will offer three selections: *List*, *Plot* and *Graph*.

- **List** presents the latest readings in a table. Press *Pause* at any time to freeze the display. Press *Print* for a hardcopy. This is one method to capture peak readings.
- **Plot** generates a plot of readings vs. time in seconds. It effectively turns the meter-PC combination into a printing digital oscilloscope.
- **Graph** generates a histogram, where the horizontal axis is the reading and the vertical axis is the number of occurrences of readings. The display continually resizes itself as the number of readings increases.

12. CUSTOM CURVE LINEARIZATION

Curve.exe is a DOS-based, executable PC program used to set up the meter so that the readings have a user-defined, non-linear relationship with the input signal. The calculated linearizing parameters are downloaded into non-volatile memory of the meter. For example, it allows a meter to correct for transducer nonlinearity. The curve-fitting algorithm uses quadratic segments of varying length and curvature, and provides diagnostics to estimate curve fitting errors. The program is self-prompting, avoiding the need for a detailed printed manual. This manual section is only intended as an introduction and get-started guide.

PREREQUISITES

1) PC-compatible computer with an available USB port.
2) An A-B USB cable to connect the meter and PC. A suitable cable is the one that comes with the AC adapter SSI-USB/ACA.
3) *Curve.exe* software (downloadable from website).

GETTING STARTED

Download *curve.exe* into the same directory that will contain your data files, such as *c:\curves*. Set the meter baud rate to 9600. To do so, press the > MENU key to get to **SEr 1**, then set the entry to **050**. Set the meter address to 1. To do so, press the > MENU key to get to **SEr 2**, then set the entry to **0011**. To execute the program from Windows, simply double-click on *curve.exe*, which is an executable file. Follow the steps on computer screens, which will prompt you and provide extensive information. Pressing **R** (Enter) returns to the main menu.

You will be given the choice to enter your data in one of four modes:

1) **Text file entry mode,** with an X value in one column and a Y value in another. There can be additional columns, which are ignored. The file must have a DOS name of up to 8 characters and the extension .RAW. There can be from 5 to 180 rows. X is the input value in mV. Y is the desired corresponding reading and can range from -99999 to 99999 with any decimal point.
2) **2-coordinate keyboard entry mode,** where an actual X input signal is applied, and the desired Y reading is entered from the keyboard.

3) **2-coordinate file entry mode,** where an actual X input signal is applied, and the desired Y reading is provided from a file.

4) **Equation entry mode,** where the coefficients of a polynomial Y = K1X^P1 + K2X^P2 + K3*X^P3 + … are entered. Up to 20 terms are allowed. An offset can be built into X.

You will be asked to supply the following:

LOW X-COORDINATE VALUE >	(normally 0)
LOW INPUT MEASUREMENT VALUE >	(normally 0)
HIGH X-COORDINATE VALUE >	(normally 10,000 mV)
HIGH INPUT MEASUREMENT VALUE >	(normally 50,000)

Position the decimal point from 6=.XXXXX, 5=X.XXX, 4=XX.XXX, 3=XXX.XX, 2=XXXX.X, 1=XXXXX. Specify the same position that you specified in the **dEc.Pt** decimal point menu selection.

Follow the steps on the screens to finish generating the custom curve. When prompted to download the file to the meter, select **Y**. When prompted to set the meter to custom curve mode, also select **Y**.

KEYPAD CONTROL

You can take a meter in and out of custom curve linearization using the meter keypad. From the Menu mode, press the > MENU key to get to **ConFG**, then set the fifth digit to either **0** (normal linear operation) or to **1** (custom curve operation).

FILES USED OR CREATED BY CURVE.EXE

1) ***.RAW** is the raw input file either supplied or created by one of the four data entry methods.

2) ***.DVD** adds three columns from which the smoothness of the input data and obvious input errors can be judged. The more data points and the smoother the data, the better the curve fit.

3) ***.NUM** lists Y readings prior to custom curve linearization and addition of the decimal point.

4) ***.CCF** is an internal file used by the software.

5) ***.SIM** lists simulated linearized meter readings and calculated corresponding errors.

6) ***.PRM** contains the final hex data that is downloaded into the meter.

13. METER CALIBRATION

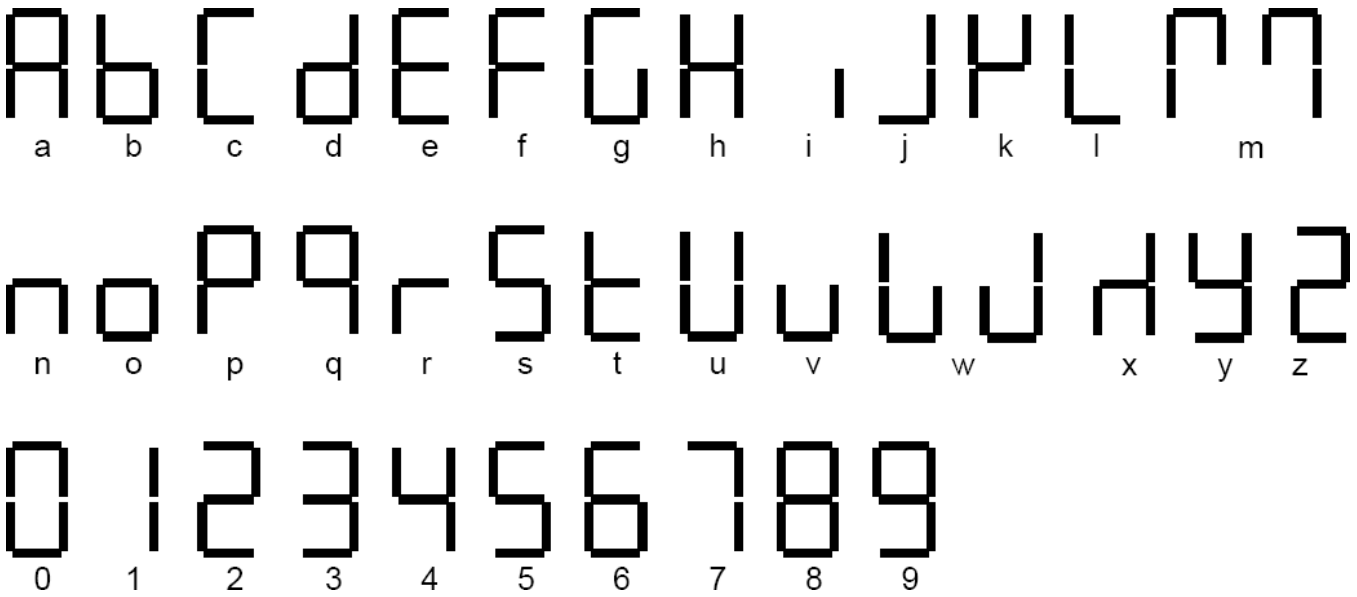
SSI meters are calibrated digitally at the factory prior to shipment using calibration equipment certified to NIST standards. Digital calibration eliminates much of circuitry that would be associated with analog calibration, providing superior long term accuracy and stability.

Calibration constants and the last meter calibration date are stored digitally in non-volatile memory in EEPROM. To retrieve the last calibration date, press RECALL for longer than 2 seconds to change to the Recall mode, then press UNITS.

The instrument calibration indicator (CAL INSTRUMENT) indicates when the meter is due for calibration. The SSI also features a clearable flashing indicator when the meter is within 30 days of the calibration due date.

Annual recalibration by the factory is recommended. Please contact Transducer Techniques for an RMA number.

14. 7-SEGMENT ALPHABET



15. SPECIFICATIONS

Display

Type ..... Reflective LCD, 2.56” x 1.73” (65 x 44 mm) window
Main numeric display ..... 6 seven-segment digits, 0.57” (14.5 mm) high
Other displayed items ..... 5-digit recall number, choice of 18 units of measure, battery life indicator, operating mode indicator
Overload indication ..... Display flashes at 120% of HiRead

Response Rates

Normal data sampling rate ..... 15,360 samples/second (setting for 60 Hz noise rejection)
12,800 samples/second (setting for 50 Hz noise rejection)
Normal conversion rate ..... Every 256 samples
60/second (setting for 60 Hz noise rejection)
50/second (setting for 50 Hz noise rejection)
Fast conversion rates ..... Every 2 to 128 samples (programmable)
Relay response rate ..... Same as Normal conversion rate
Display update rate ..... Every 16 conversions
3.750/second (setting for 60 Hz noise rejection)
3.125/second (setting for 50 Hz noise rejection)
Peak & valley capture rate (selectable) ..... Every 2, 4, 8, 16, 32, 64, 128 or 256 samples
Peak & valley display update rate ..... 3.750/second (setting for 60 Hz noise rejection)
3.125/second (setting for 50 Hz noise rejection)

Analog-to-Digital Conversion

Recommended load ..... 120-10K ohm bridge
Bridge excitation voltage 3.0V
Provision for variations in bridge excitation ..... Ratiometric operation
Signal span, max ..... 15 mV
Transducer sensitivity range ..... 1-5 mV / V
A-to-D converter resolution ..... 16 bits (65,536 counts)
Signal resolution ..... 0.5 µV/count
Accuracy at 25°C ..... ±1.5 µV
Span Tempco ..... 0.0015% of reading/°C
Zero Tempco ..... 0.2 µV/°C
NMR with no filtering ..... 90 dB
Signal filtering (selectable) ..... 1) No filtering: 50 or 60 conversions/second
2) Batch average of 16 conversions
3) Moving average of conversions

Power Requirements

Internal battery ..... Rechargeable lithium ion
Battery capacity (nominal) ..... 2400 mAh, 3.7V
RUN time on single battery charge ..... Up to 65 hours with 350 ohm bridge
Battery charger ..... Wall plug AC power unit
Battery charger input ..... 100-240V ac, 50/60 Hz, 0.15A
Battery charger output ..... 5.0V dc, 1.0A
Battery charging time, max ..... 8 hours

Battery charge indication ..... Battery symbol with 4 bars to show percent of full charge
4 bars = 80% - 100%, 3 bars = 60% - 80%, 2 bars = 40% - 60%, 1 bar = 20% - 40%,
flashing battery symbol = 0% - 20%

Relay Output

Relay types ..... Dual relays with single common, solid state
AC rating ..... 120 mA @ 350Vac peak, 35 ohms series resistance
DC rating ..... 120 mA @ 350Vdc, 35 ohms series resistance
Isolation to signal common ..... 5300 Vac rms
Setpoint setup ..... Via keypad or PC
Response rate (selectable) ..... 60/second or 50/second (each 1 conversion or 256 samples)
Response filtering (selectable) ..... Filtered or unfiltered
Active modes (selectable) ..... Above or below setpoint, latching or non-latching, disabled
Visual active Alarm Indication ..... AL1 LED (yellow), AL2 LED (red), Go (green)
Audible active alarm indication ..... Selectable
Activation time delay (selectable) ..... 1 to 128 conversions
Setpoint / lockout modes (selectable) ..... 1) Display and change setpoints
2) Display but do not change setpoints
3) Neither display nor change setpoints

Serial Interface to PC

Signal type ..... USB 2.0
Baud rates (selectable) 300, 600, 1200, 2400, 4800, 9600, 19200, 38400
Serial protocol ..... Point-to-point ASCII, PC compatible

Control Inputs

Number of inputs ..... 2 (A & B)
Input activation ..... Short to ground
Control input action ..... Meter Reset, Function Reset, Display Peak or Valley,
Tare, Tare Reset, Log

Mechanical

Dimensions ..... 1.28” x 3.30” x 7.50” (32 x 84 x 185 mm)
Weight ..... 10 oz (280 g)
Case material ..... ABS-94HB plastic
Provision for stand ..... 3 inserts, 8-32 UNC threads, 3/8” deep
..... 1.500” triangle base, 1.750 triangle height (see photo on page 6)
Keypad ..... Membrane type, 8-keys with tactile feedback
Display type ..... Reflective LCD
Displayed info ..... 6 large digits, 5 small digits, charge bargraph, units of measure, indicators
Electrical connectors ..... DB9 male for TEDS and signal connection to load cell,
3-pin jack plus detachable connector for dual relay outputs
3-pin jack plus detachable connector for control inputs
10 foot (3 m) USB cable to charging unit or computer

Environmental

Operating temperature ..... 0°C to 55°C
Storage temperature ..... -20°C to 60°C
Relative humidity ..... 95% from 0°C to 40°C, non-condensing
Environmental sealing ..... Dust and humidity resistant

Peak-to-Peak Noise as a Percentage of Full Scale

Conversion type	Filter setting	Filter time constant	Load cell sensitivity			
			1 mV/V	2 mV/V	3 mV/V	4 mV/V
Normal	A	No filter	0.03	0.02	0.01	< 0.01
Normal	1	16 conv. batch avg.	< 0.01	< 0.01	< 0.01	< 0.01
Normal	2	0.08 sec	0.01	0.01	< 0.01	< 0.01
Normal	3	0.14 sec	0.01	< 0.01	< 0.01	< 0.01
Normal	4	0.3 sec	< 0.01	< 0.01	< 0.01	< 0.01
Normal	5	0.6 sec	< 0.01	< 0.01	< 0.01	< 0.01
Normal	6	1.2 sec	< 0.01	< 0.01	< 0.01	< 0.01
Normal	7	2.4 sec	< 0.01	< 0.01	< 0.01	< 0.01
Normal	8	4.8 sec	< 0.01	< 0.01	< 0.01	< 0.01
Normal	9	9.6 sec	< 0.01	< 0.01	< 0.01	< 0.01
Fast 1	No filter	120 conv./sec	0.06	0.03	0.02	0.01
Fast 2	No filter	240 conv./sec	0.08	0.04	0.03	0.02
Fast 3	No filter	480 conv./sec	0.11	0.06	0.04	0.03
Fast 4	No filter	960 conv./sec	0.16	0.08	0.05	0.04
Fast 5	No filter	1920 conv./sec	0.23	0.11	0.08	0.06
Fast 6	No filter	3840 conv./sec	0.32	0.16	0.11	0.08
Fast 7	No filter	7680 conv./sec	0.45	0.22	0.15	0.11

16. GLOSSARY OF TERMS

Adaptive Filter Threshold

A threshold which causes an adaptive moving average filter to be reset to the latest reading when the accumulated difference between individual readings and the filtered reading exceeds that threshold. Adaptive moving average filtering allows a meter to respond rapidly to actual changes in signal while filtering out normal noise.

Alarm, Latched

An alarm that stays actuated until reset. Latched alarms can maintain a shut-down condition or maintain an alarm until acknowledged by an operator.

Alarm, Non-latched

An alarm which changes state automatically when the reading rises above a specified limit and changes back automatically when the reading falls below a limit. Also called “Auto Reset.”

Auto-filter A selectable digital filter mode that automatically selects an appropriate moving average filter time constant for the encountered noise condition.

Batch Average Filter

A digital filter mode where readings are the displayed average of 16 conversions. Conversions are made at 60/second in a 60 Hz environment and 50/second in a 50 Hz environment.

Deviation Band

A value which controls relay action symmetrically around a setpoint. The relay activates when the reading falls within the deviation band, and de-activates when the reading falls outside. A deviation value (e.g., 50 counts) is set up around both sides of the setpoint to create a deviation band or pass band (e.g., 100 counts), which equals two deviation values.

First Peak The first maximum (or most positive) reading followed by a decrease of a selectable percentage Full Scale since that maximum was last reset.

Full Scale The reading range equal to Hi Rd - Lo Rd.

Hysteresis A value which controls relay action symmetrically around a setpoint. The relay closes (or opens) when the reading goes above the setpoint plus the hysteresis value, and opens (or closes) when the reading falls below the setpoint less the hysteresis value. A narrow hysteresis band is often used to minimize relay chatter around a setpoint due to electrical noise or signal feedback caused by load switching. A wide hysteresis band can be used for control applications. The hysteresis band equals two hysteresis values.

Moving Average Filter

A digital filter mode that displays a weighting moving average of readings. Readings are taken at 60/second in a 60 Hz power environment and 50/second in a 50 Hz power environment. Display update rates remain at 3.75/second at 60 Hz and 3.13/second at 50 Hz. There are eight moving average modes:

Old average x 1/2 + new reading x 1/2 (equivalent to 0.08 sec RC time constant).
Old average x 3/4 + new reading x 1/4 (equivalent to 0.15 sec RC time constant).
Old average x 7/8 + new reading x 1/8 (equivalent to 0.3 sec RC time constant).
Old average x 15/16 + new reading x 1/16 (equivalent to 0.6 sec RC time constant).
Old average x 31/32 + new reading x 1/32 (equivalent to 1.2 sec RC time constant).
Old average x 63/64 + new reading x 1/64 (equivalent to 2.4 sec RC time constant).
Old avg. x 127/128 + new reading x 1/128 (equivalent to 4.8 sec RC time constant).
Old avg. x 255/256 + new reading x 1/256 (equivalent to 9.6 sec RC time constant).

Peak Display The maximum (or most positive) reading since that maximum was last reset. Reset can be via the meter keypad, a control input, or a serial USB command. For Normal conversions, the displayed value can be the peak of filtered or unfiltered readings.

Plug & Play A system where a TEDS sensor and an instrument are automatically scaled as a system at power on.

Reading The current value displayed by the meter. Readings are updated at 3.75/second in a 60 Hz environment and 3.125/second in a 50 Hz environment.

Reset There are three types of Reset:

- Peak and Valley Reset. Achieved by simultaneously pressing the *RESET* and *PEAK* keys.
- Latched Alarm Reset. Achieved by simultaneously pressing the *RESET* and *ALARMS* keys.
- Meter Reset. Causes the meter to reinitialize and take a tare reading when set up for *auto-tare*. Achieved by powering up the meter, pressing the *RESET* and *MENU* keys simultaneously, stepping through all menu items, grounding an external control input, or supplying an ASCII command. *rESEt* is displayed briefly.

Run Mode The normal operating mode of the meter, where readings are taken, as opposed to the Menu or Recall modes.

Sampling Rate
The rate at which data is collected for further processing. In the SSI, this is 15,360 samples/second.

Scaling The setup process which relates signal inputs to numeric readings in engineering units (such as psi).

Scaling, Coordinates of 2 Points Method
A scaling method where four numbers are entered manually: low input, desired reading at low input; high input, and desired reading at high input. The meter then applies a straight line fit.

Scaling, Reading Coordinates of 2 Points Method
A scaling method that uses actual measurements of low and high inputs. A known low signal is first applied to the meter, and the desired low reading is entered. A known high signal is then applied, and the desired high reading is entered. The meter then applies a straight line fit. This scaling method has the advantage of calibrating the transducer and meter as a system. The actual voltage or current at either point does not need to be known.

Setpoint A value compared to the reading to force the state of a relay. Term often used interchangeably with “alarm setpoint.” The relay action can be *latching* or *non-latching* and utilize a *hysteresis band* or *deviation band*. Hysteresis bands and deviation bands are specified by two symmetrical limits around the *setpoint*.

Tare A constant value that is subtracted from the meter reading to set the reading to zero. In weighing applications, tare refers to the weight of the empty container. Tare is subtracted from gross weight to obtain net weight.

TEDS 1451.4 Transducer Electronic Data Sheet (TEDS), a set of electronic data in a format defined by the IEEE 1451.4 standard. This data is on a chip that is part of the transducer. The data specifies the type of sensor, the scaling constants, and the unit of measure. By incorporating this chip, the sensor can describe itself to a smart load cell meter or network Plug and Play system configuration.

Valley Display
The minimum (or most negative) reading since that minimum was last reset. Reset can be via the meter keypad, a control input, or a serial USB command. The displayed value can reflect the filtered or unfiltered reading.

Zero A setting by ZEro menu item, which allows the meter to display zero when the signal level is below a specified percentage of full scale span. This avoids meaningless noise readings when the reading should be zero.

17. WARRANTY & REPAIR POLICY

Limited Warranty on Products

Any of our products which, under normal operating conditions, proves defective in material or in workmanship within one (1) year from the date of shipment by Transducer Techniques, will be repaired or replaced free of charge provided that you obtain a return material authorization from Transducer Techniques and send the defective product, transportation charges prepaid with notice of the defect, and establish that the product has been properly installed, maintained, and operated within the limits of rated and normal usage. Replacement product will be shipped F.O.B. our plant. The terms of this warranty do not extend to any product or part thereof which, under normal usage, has an inherently shorter useful life than one year. The replacement warranty detailed here is the Buyer's exclusive remedy, and will satisfy all obligations of Transducer Techniques, whether based on contract, negligence, or otherwise. Transducer Techniques is not responsible for any incidental or consequential loss or damage which might result from a failure of any Transducer Techniques' product. This express warranty is made in lieu of any and all other warranties, expressed or implied, including implied warranty of merchantability or fitness for particular purpose. Any unauthorized disassembly or attempt to repair voids this warranty.

Obtaining Service Under Warranty

Advance authorization is required prior to the return to Transducer Techniques. Before returning the item(s), either write to the Repair Department c/o Transducer Techniques, 42480 Rio Nedo, Temecula, CA 92590, or call (951) 719-3965 with: 1) a part number; 2) a serial number for the defective product; 3) a technical description of the defect; 4) a no-charge purchase order number (so products can be returned to you correctly); and, 5) ship to and bill to addresses. Shipment to Transducer Techniques shall be at Buyer's expense, and repaired or replacement items will be shipped F.O.B. our plant in Temecula CA. Non-verified problems or defects may be subject to a $75 evaluation charge. Please return the original calibration data with the unit.

Obtaining Non-Warranty Service

Advance authorization is required prior to the return to Transducer Techniques. Before returning the item(s), either write to the Repair Department c/o Transducer Techniques, 42480 Rio Nedo, Temecula, CA 92590, or call (951) 719-3965 with: 1) a model number; 2) a serial number for the defective product; 3) a technical description of the malfunction; 4) a purchase order number to cover Transducer Techniques' repair cost; and 5) ship to and bill to addresses. After evaluating the product, we will contact you to provide the estimated repair costs before proceeding. The minimum evaluation charge is $75. Shipment to Transducer Techniques shall be at Buyer's expense, and repaired items will be shipped to you F.O.B. our plant in Temecula, CA. Please return the original calibration data with the unit.

Repair Warranty

All repairs of Transducer Techniques' products are warranted for a period of 90 days from the date of shipment. This warranty applies only to those items that were found defective and repaired; it does not apply to products in which no defect was found and returned as is, or merely recalibrated. Out-of-warranty products may not be capable of being returned to the exact original specifications or dimensions.

FOR TECHNICAL SUPPORT, CALL

(800) 344-3965 / FAX (951) 719-3900

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PRECISION MEASUREMENT SYSTEMS

42480 RIO NEDO, TEMECULA, CA 92590
(951) 719-3965 FAX (951) 719-3900
URL: www.transducertechniques.com
Email: tti@ttloadcells.com